SPACE TECHNOLOGIES FOR SUSTAINABLE DEVELOPMENT

Space technologies can be used for a great variety of applications. Beyond the uses directly connected with defence, there are important contributions for sustainable development and security. Spaceborne Earth Observation (EO, or Remote Sensing) offers a different perspective of the earth: you can obtain a huge amount of information regarding land-use and natural hazards, population estimation, characteristic of the solid earth, atmosphere chemistry, climate variability and prediction, aspects of the global water and energy cycle, biology and biochemistry of ecosystems. Spaceborn sensors are able to deliver adequate, independent and objective information both spatially and punctually. These data can be integrated in a Geographical Information System (GIS), where information layers of different origin can be displayed, inter-linked and analysed.

According to this, the United Nations adopted in 1967 the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (OST), aimed at the peaceful exploitation and exploration of Space for the benefit of all countries. After this, the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS), aware of the importance of Space for development, adopted in 1996 the Declaration on International Cooperation in the Exploitation and Use of Outer Space for the Benefit and in the Interest of all States, taking into Particular Account the Needs of Developing Countries.

The European Commission adopted in 2003 the White Paper on Space: a new European frontier for an expanding Union – An action plan for implementing the European Space Policy where great attention was paid to cooperation in Space with developing countries.

This cooperation should benefit in particular the countries that will enjoy the European Union and those connected with the Barcelona recommendations of 1995: North Africa and Middle East. The cooperation with international development banks and with United Nations Agencies is recommended, so as to identify the most suitable space technologies facing the specific problems of different regions.
Space cooperation with developing countries requires three main actions:
1. capacity building: education and training;
2. access to information and data sharing;
3. technical assistance and technology transfer.

Capacity building encompasses a country’s human, scientific, technological, organisational and institutional infrastructures, resources and capabilities. For this reason, these countries have to promote education in space for sustainable development, create awareness for policymakers and other end users about space applications.

The space technology is very complex, only a restricted club of countries is able to implement it. To make these technologies available you need to afford very high costs for the initial investments, increased by the rapid evolution of software and hardware solutions. Another problem, connected with education, is that in these regions the skills needed to interpret and manage data for the operational applications do not exist. Finally, the transfer of data is very difficult because of the need for telecommunication infrastructures.

EARTH OBSERVATION AND DATA POLICY

The information provided by EO is very sensitive and often their access is not possible because they deal with the independence and the strategic resources of a country. For this reason the United States, for example, has a strict data policy ruling the transfer of strategic information. The problem, indeed, is that they have a “Dual Use”, that means they can be used either for defence or for civil purposes.

According to the UN Principles Relating to Remote Sensing of the Earth from Space, there are two main legal principles:
- free access to data on an open and non-discriminatory basis, that means wide availability of data to all interested users;
- freedom of observation over all territories of the world.

As soon as the primary data and the processed data concerning the territory under its jurisdiction are produced, the sensed state shall have access to them on a non-discriminatory basis and on reasonable cost terms. The same is valid for analyzed information (Principle XII). This right is of great concern for developing countries: the high cost of space activities could limit their possibilities. A possible danger is that with Remote-Sensing satellites natural resources are not under their exclusive control. This could create a kind of dependence from another country that could use this information for its own interests.

The European Space Agency (ESA), that is one of the principle EO
satellites owners, aims at encouraging the widest possible access and use of the data. Data generated by the satellite is provided by ESA to the user and this is done after acceptance of the terms and conditions of use containing the license and against the payment of a cost that can be different depending on the purpose of the use. In the case of research and applications development use, it is a simple reproduction cost, while a higher price has to be paid in the case of operational and commercial use. In case of disasters, data is free of charge.

The problem with technology transfer is not only the will and the political aspects connected to them, but also the legislative framework existing in the donor and the beneficiary country. The lack of a legal framework in charge of increasing the protection of intellectual property rights and the institutional and human resistance to information sharing is a great obstacle for cooperation in space.

Although there are obstacles, there are many examples of space cooperation with developing countries, among which we could mention the UN-SPACE III, the third UN Conference of the Exploration and Peaceful Uses of Outer Space, the Global Earth Observation System of Systems (GEOSS) and the International Charter of Space and Disaster Management.

MOROCCO AND INTERNATIONAL SPACE COOPERATION

Over 70% of disasters in the African continent are related to extreme climatic events, in particular drought and floods. Desertification is one of the most relevant problems: in the next twenty years Africa will lose half of its reservoir fertile lands due to deforestation, erosion and land mismanagement. Space applications would offer a very effective tool for facing these problems.

Morocco is becoming more and more active in Space Activities among the North African countries. It has competences in micro-satellites but it is focusing in particular on Remote Sensing. The Royal Center for Space Studies and Research (CRERS) is the centre in charge of the space technology and the Royal Centre for Remote Sensing (CRTS) is responsible for the development of capacities at the national level, the coordination and execution of the national programs of Remote Sensing and the provision of training and education opportunities in space technologies.

From a jurisdictional point of view, it can be said that Morocco is one of the most advanced in space law. Although Morocco does not have its own national space law, it has already ratified 4 of the five UN Space Treaties and is a COPUOS member since 1961. The other North-African countries recently joined COPUOS (with the only exception of Egypt) and have not ratified the UN treaties or they have not adopted the treaties at all.
The position of Morocco in space is characterized by a great attitude in international cooperation, thanks to which it is working on many projects together with the European Union, the European Space Agency and other space agencies.

The United Nations General Assembly, in its resolution 45/72 of December 1990, endorsed the recommendation of the COPUOS that the United Nations should lead, with the active support of its specialized agencies and other international organizations, an international effort to establish regional centres for space science and technology education in existing national/regional educational institutions in developing countries.

Regional centres have been established in India for Asia and the Pacific, in Morocco (Rabat) for French speaking Africa and Nigeria for English speaking Africa, in Brazil and Mexico for Latin America and the Caribbean and in Jordan for Western Asia, under the auspices of the Programme on Space Application, implemented by the Office for Outer Space Affairs. The objective of the centres is to enhance the capabilities of member states, at the regional and international levels, in various disciplines of space science and technology that can advance their scientific, economic and social development. Each of the centres provide postgraduate education, research and application programmes with emphasis on remote sensing, satellite communications, satellite meteorology and space science.

Morocco is strongly supporting a policy of sensation, promotion and extension of the use of space to other domains mainly by strengthening training and international cooperation programs, by organising exhibits and information events to make policy makers and other institutions aware of the contribution of science space and technologies. The launch in December 2001, of a micro-satellite confirms the will of Morocco to develop national capacities for an ef-
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efficient use of space for sustainable development. Morocco also edits a scientific review, “Geo Observateur”, which reports on a regular basis the results of works and researches undertaken in developing countries.

The reason why Morocco is investing in this field is that its territory is subjected to problems of floods and earthquakes. On 24 February 2004, for example, the city of Al Hoceima on the Mediterranean coast was hit by a 6.5 magnitude earthquake with significant human casualties and property damage. On 25 November 2002, the northern part of the country was hit by heavy rains that affected urban and agricultural areas in regions around Casablanca. One of the most affected areas was that of Berrechid. In both cases the International Charter “Space and Major Disasters” was activated. According to its specific problems, the two most important thematic projects of space cooperation supported by Morocco are:

- marine resources management: aquaculture, upwelling and legal resources;
- forest resource management: change mapping, forest fires, global vegetation monitoring.

There are many examples of international space cooperation facing these problems. ESA, for instance, is involved in a very important program concerning all of Africa: the TIGER project, Earth Observation for Integrated Water Resources Management in Africa. There are different projects in various African regions and, among others, there are two start-up projects concerning Morocco: “Analysis, qualification et suivi des phénomènes géologiques et hydrogéologiques dans la zone des Doukkala-Abda et son littoral Atlantique: Apport de la télédétection spatiale” and “Télédétection et Information Spatiale pour la Gestion intégrée des Ressources en Eau dans le bassin hydraulique de Souss-Massa (Agadir, Maroc)”. Both of these initiatives are primarily supported by the Rabat CRTS.

The European Union has funded in the past and is presently funding space cooperation projects with Morocco. RAMSES, Regional Earth Observation for Mediterranean Sea Emergency Surveillance, was an EU ESPRIT project where CRTS took part. The aim is oil spill monitoring in the Mediterranean. This project was concluded in 2001 and has proved to be very successful, for this reason it will be operational in all of the Mediterranean using the new generation of EO satellites in orbit.
NOTES

1 Remote Sensing is “the measurement or acquisition of information of some property of an object or phenomenon, by a recording device that is not in physical or intimate contact with the object or phenomenon under study” (Colwell, 1997).

2 Resolution 2222 (XXI) opened for signature on 27 January 1967 and entered into force on 10 October 1967. 98 ratifications and 27 signatures (as of 1 January 2005).

3 Resolution 51/122 of 13 December 1996.

4 COM (2003) 673


6 The European and French space agencies (ESA and CNES) initiated the International Charter “Space and Major Disasters”, with other space agencies signing the Charter during the following years. The International Charter aims at providing a unified system of space data acquisition and delivery to those affected by natural or man-made disasters through authorized users. Each member agency has committed resources to support the provisions of the Charter and thus is helping to mitigate the effects of disasters on human life and property.

7 The Kingdom of Morocco has ratified four of the five treaties concerning the use of space:
   - the outer space treaty
   - the rescue agreement
   - the liability convention
   - the Moon agreement

8 A/AC.105/456, annex II, para.4 (n)

9 EU ESPRIT - Project 28245

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